CLAIM + DETAILED DESCRIPTION

[Claim(s)]

[Claim 1]A coating liquid nozzle is made to counter a substrate held at a level with a substrate attaching part characterized by comprising the following, A process of applying coating liquid to a substrate by moving a coating liquid nozzle in the direction of X, making coating liquid breathing out from this coating liquid nozzle, moving a coating liquid nozzle relatively to the direction of Y to a substrate attaching part after that, and repeating this operation, Subsequently, a method of determining a processing parameter in performing a process of performing decompression dryness for a substrate within an airtight container, and forming a coating film.

Apply to a substrate coating liquid which dissolved solid content which is an ingredient of a coating film in a solvent from a coating liquid nozzle, and a liquid film of various thickness is formed, A process of asking for thickness of a high liquid film of homogeneity within a field of film thickness of a coating film produced by drying this liquid film, and asking for solid content concentration of coating liquid which is a processing parameter as target film thickness is obtained by thickness of this liquid film.

Using coating liquid of solid content concentration fixed at this process, change various the amounts of discharge flow of a scan pitch which is the relative intermittent migration length of the direction of Y of a substrate to a coating liquid nozzle, and a coating liquid nozzle, and a coating film of target film thickness is formed on a substrate, A process of calculating a scan pitch and the amount of discharge flow which are a high processing parameter of homogeneity within a field of film thickness of a coating film, A process of forming a liquid film on a substrate so that target film thickness may be obtained by a scan pitch and a flow which were already calculated using coating liquid of solid content concentration for which it already asked, and changing various processing parameters at the time of decompression dryness, and asking for a processing parameter at the time of high decompression dryness of the homogeneity within

a field of film thickness of a coating film.

[Claim 2]After calculating a high scan pitch and the amount of discharge flow of homogeneity within a field of film thickness of a coating film, Change various hole diameters of a coating liquid nozzle, and a liquid film is formed on a substrate so that target film thickness may be obtained using a processing parameter for which it already asked, A deciding method of a processing parameter of the coating film formation according to claim 1 performing a process of asking for a hole diameter of a coating liquid nozzle which is a high processing parameter of homogeneity within a field of film thickness of a coating film.
[Claim 3][a process of asking for a processing parameter at the time of decompression dryness] Various exhaust air speed until a solvent decompresses inside of an airtight container from air atmosphere to pressure which evaporates violently is changed, Exhaust air speed which is a high processing parameter of homogeneity within a field of film thickness of a coating film including a process to search for, [this process] A deciding method of a processing parameter of the coating film formation according to claim 1 or 2 carrying out before a process of deciding on evaporation time when temperature and a solvent of a substrate which are processing parameters evaporate violently by adjustment of exhaust air speed.
[Claim 4]A deciding method of a processing parameter of the coating film formation according to claim 1 or 2 characterized by comprising the following.
A process of a process of asking for a processing parameter at the time of decompression dryness changing various exhaust air speed until it decompresses inside of an airtight container to pressure to which a solvent evaporates violently from air atmosphere, and finding exhaust air speed which is a high processing parameter of homogeneity within a field of film thickness of a coating film.
A process of decompressing inside of an airtight container to pressure to which a solvent evaporates violently at exhaust air speed found at this process, changing various temperature of a substrate, and asking for temperature of a substrate which is a high processing parameter of homogeneity within a field of film thickness of a coating film, A process of changing variously evaporation time when a solvent evaporates violently by adjustment of exhaust air speed using a processing parameter for which it already asked, and finding evaporation time which is a high processing parameter of homogeneity within a field of film thickness of a coating film.

[Claim 5]A deciding method of a processing parameter of the coating film formation according to claim 1 or 2 characterized by comprising the following.
A process of a process of asking for a processing parameter at the time of decompression dryness changing various exhaust air speed until it decompresses inside of an airtight

container to pressure to which a solvent evaporates violently from air atmosphere, and finding exhaust air speed which is a high processing parameter of homogeneity within a field of film thickness of a coating film.
A solvent decompresses inside of an airtight container to pressure which evaporates violently at exhaust air speed found at this process, A process of changing variously evaporation time when a solvent evaporates violently by adjustment of exhaust air speed, and finding evaporation time which is a high processing parameter of homogeneity within a field of film thickness of a coating film, Then, a process of changing various temperature of a substrate and asking for temperature of a substrate which is a high processing parameter of homogeneity within a field of film thickness of a coating film using a processing parameter for which it already asked.

[Claim 6]A deciding method of a processing parameter of the coating film formation according to claim 4 or 5 characterized by comprising the following.
Exhaust air speed until it decompresses a process of decompression dryness being performed by forming a current plate so that it may counter with this near the substrate face, and asking for a processing parameter at the time of decompression dryness, to pressure to which a solvent evaporates violently from air atmosphere.
Said evaporation time.
Temperature of said substrate.
A process of changing various gaps between a substrate and said current plate into the next, and asking for a gap which is a high processing parameter of homogeneity within a field of film thickness of a coating film after determining.

[Claim 7][including a process for which decompression dryness enlarges a gap between a substrate and said current plate while a solvent has evaporated violently] [a process of asking for a processing parameter at the time of decompression dryness] After asking for a high gap of homogeneity within a field of film thickness of a coating film, a processing parameter for which it already asked is used, A deciding method of a processing parameter of the coating film formation according to claim 6 including a process of changing various timing which enlarges said gap and asking for timing which is a high processing parameter of homogeneity within a field of film thickness of a coating film.
[Claim 8]In a process of applying coating liquid to a product board after determining a processing parameter at the time of an application of coating liquid to a substrate, and a processing parameter at the time of decompression dryness, A deciding method of a processing parameter of the coating film formation according to any one of claims 1 to 7 deciding direction of a product board that a direction where said crevice is prolonged, and the

scanning direction of a coating liquid nozzle cross when two or more crevices are formed in a ground film of a product board in the shape of parallel.

[Claim 9]In a process of applying coating liquid to a product board after determining a processing parameter at the time of an application of coating liquid to a substrate, and a processing parameter at the time of decompression dryness, A deciding method of a processing parameter of the coating film formation according to any one of claims 1 to 7 tuning an already fixed scan pitch finely according to a position of unevenness of a ground film of a product board.

[Claim 10]A substrate attaching part holding a substrate, and a coating liquid nozzle which counters with a substrate held at this substrate attaching part, is provided, and carries out discharge of the coating liquid to the substrate concerned, A coating liquid supply control section which controls discharge of coating liquid from this coating liquid nozzle, Y direction drive made to move relatively intermittently an X direction drive made to move said coating liquid nozzle in the direction of X, and said substrate attaching part and a coating liquid nozzle in the direction of Y, An airtight container for carrying out decompression dryness of the substrate in which a liquid film of coating liquid was formed of said coating liquid nozzle, A storage part which remembers a processing parameter when forming a liquid film of coating liquid, and a processing parameter when carrying out decompression dryness to be evacuation means to evacuate inside of this airtight container, Formation of a liquid film by a preparation and coating liquid moves the coating liquid nozzle concerned in the direction of X, making coating liquid breathe out from a coating liquid nozzle, where said substrate attaching part is stopped, A coating film forming device, wherein it moves a substrate attaching part and a coating liquid nozzle in the direction of Y relatively after that, and is carried out by repeating this operation and a processing parameter in a storage part is determined by Claim 4 or a method of 5.

[Claim 11]The coating film forming device according to claim 10, wherein a temperature control means for adjusting temperature of a substrate is established in said airtight container.

[Claim 12]In an airtight container, a current plate is formed so that it may counter with this near the substrate face, and, [in said storage part] The coating film forming device according to claim 10 or 11, wherein a gap of a substrate and a current plate which are one of the processing parameters determined by Claim 6 or a method of 7 is memorized.

[Claim 13]Have a means to go up and down a current plate, and, [said current plate] The coating film forming device according to any one of claims 10 to 12, wherein timing which raises a current plate which is one of the processing parameters which went up while a solvent had evaporated violently, and were determined by a method of Claim 7 in said storage part is memorized.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention applies coating liquid, such as resist liquid, to substrates, such as a semiconductor wafer and an LCD board (glass substrate for liquid crystal displays), and relates to the method of determining a processing parameter, and the device which forms said coating film in the method of carrying out decompression dryness of the substrate face subsequently, and forming a coating film.

[0002]

[Description of the Prior Art]In the manufacturing process of a semiconductor device or LCD, the resist pattern to a substrate is formed with the art called photo lithography. As a method of applying resist liquid to a substrate conventionally, resist liquid was supplied to the central part of the substrate, and what is called a spin coating method that is made to rotate a substrate, opens resist liquid by centrifugal force and is applied was in use.

[0003]However, if the high velocity revolution of the substrate is carried out in order that a spin coating method may respond to thin film-ization, Since there is concern which the peripheral velocity of a peripheral part becomes large as compared with an inner periphery, and becomes a factor which the turbulent flow of air occurs [factor] and fluctuates film thickness, and it is diffused from the central part of a wafer as resist liquid is blown away in the direction of a periphery, SUBJECT that the quantity of the resist liquid which disperses from the edge part concerned to the cup side, and becomes useless will increase is pointed out.

[0004]From such a situation, it replaces with a spin coating method and the following techniques are examined. It is made to go and come back to this technique in the direction of X, supplying the resist liquid RE from the narrow discharge opening of the nozzle N provided above the wafer W, as shown in drawing 16, and it carries out intermittent sending of the wafer W in the direction of Y, and supplies resist liquid to the wafer W in the so-called way of a picture drawn without lifting the brush from the paper. In order to prevent resist liquid from adhering to the periphery and the back of the wafer W in this case, it is preferred to cover portions other than the circuit formation field of the wafer W with a mask. By this technique, it is canceled and inconvenience which was mentioned above since the wafer W was not rotated can perform the useless application which is not. And especially this coating method is preferred when substrate size is large, but since it will be affected by the influence of field internal temperature degree distribution of a part with a large substrate and a heating plate if dryness by a heating plate is performed by a next process, the decompression drying process which decompresses the inside of an airtight container and is dried is examined.

[0005]

[Problem to be solved by the invention]However, an above-mentioned scanning coating

method is added to the solid content concentration of coating liquid, Although it is necessary to set processing parameters, such as a hole diameter of a coating liquid nozzle, the amount of discharge of resist liquid, a scanning speed (movement speed of the direction of X) of a coating liquid nozzle, and a scan pitch (intermittent migration length) of a coating liquid nozzle, the optimal, what to set up from which processing parameter since there are many processing parameters -- it is unknown how it should have set up and, under the present circumstances, the parameter is adjusted with trial and error.

[0006][the decompression drying process performed after the application of resist liquid] The inside of an airtight container is decompressed so that it may become pressure somewhat higher than the pressure to which a solvent volatilizes violently, for example, the pressure to boil, and in order to stop that the liquid film in the edge part of a substrate is round with surface tension, the current plate is arranged so that it may counter with the substrate concerned near the surface of a substrate. Therefore, if a processing parameter is decided in which turn also in decompression dryness also including a processing parameter [in / there are many processing parameters, such as the method of decompression, temperature of a substrate, and height of a current plate, and / previous application processing], It is unknown about whether the high resist film of the homogeneity within a field is obtained, and for this reason, the processing parameter of a series of processes of a resist application and decompression dryness is decided by trial and error, work is troublesome, and it is difficult to obtain the high coating film of the homogeneity within a field.

[0007]Providing the deciding method and coating film forming device of a processing parameter of easy coating film formation has a setup of the parameter for this invention being made under such a situation, and the high coating film of the homogeneity within a field being obtained as for the purpose, and obtaining required film thickness.

[0008]

[Means for solving problem]This invention makes a coating liquid nozzle counter the substrate held at a level with a substrate attaching part, The process of applying coating liquid to a substrate by moving a coating liquid nozzle in the direction of X, making coating liquid breathing out from this coating liquid nozzle, moving a coating liquid nozzle relatively to the direction of Y to a substrate attaching part after that, and repeating this operation, Subsequently, in performing the process of performing decompression dryness for a substrate within an airtight container, and forming a coating film, the method of determining a processing parameter is equipped with the following.

Apply to a substrate the coating liquid which dissolved the solid content which is an ingredient of a coating film in the solvent from a coating liquid nozzle, and the liquid film of various thickness is formed, The process of asking for the thickness of the high liquid film of the homogeneity within a field of the film thickness of the coating film produced by drying this liquid

film, and asking for the solid content concentration of the coating liquid which is a processing parameter as target film thickness is obtained by the thickness of this liquid film.
Using the coating liquid of the solid content concentration fixed at this process, change various the amounts of discharge flow of the scan pitch which is the relative intermittent migration length of the direction of Y of the substrate to a coating liquid nozzle, and a coating liquid nozzle, and the coating film of target film thickness is formed on a substrate, The process of calculating the scan pitch and the amount of discharge flow which are a high processing parameter of the homogeneity within a field of the film thickness of a coating film.
The process of forming a liquid film on a substrate so that target film thickness may be obtained by the scan pitch and flow which were already calculated using the coating liquid of solid content concentration for which it already asked, and changing various processing parameters at the time of decompression dryness, and asking for the processing parameter at the time of high decompression dryness of the homogeneity within a field of the film thickness of a coating film.

[0009]In determining a hole diameter of a coating liquid nozzle, [in this invention] After calculating a high scan pitch and the amount of discharge flow of homogeneity within a field of film thickness of a coating film, Various hole diameters of a coating liquid nozzle are changed, a liquid film is formed on a substrate so that target film thickness may be obtained using a processing parameter for which it already asked, and a process of asking for a hole diameter of a coating liquid nozzle which is a high processing parameter of homogeneity within a field of film thickness of a coating film is performed.
[0010]In finding exhaust air speed until it decompresses inside of an airtight container to pressure to which a solvent evaporates violently from air atmosphere in asking for a processing parameter at the time of decompression dryness, Various these exhaust air speed is changed, and although **** is good in a high exhaust air speed of homogeneity within a field of film thickness of a coating film, this process is performed before a process of deciding on evaporation time when temperature and a solvent of a substrate which are processing parameters evaporate violently by adjustment of exhaust air speed.
[0011]Pressure in which a solvent evaporates violently here is the pressure from which exhaust air by an evacuation means and evaporation of a solvent balance, and inside of an airtight container becomes steam pressure of a solvent, or the steam pressure near it, when inside of an airtight container is decompressed, for example, it is somewhat large pressure rather than resulting in the boiling point of a solvent.
[0012][a process of asking for a processing parameter at the time of decompression dryness again] A process of changing various exhaust air speed until it decompresses inside of an airtight container to pressure to which a solvent evaporates violently from air atmosphere, and

finding exhaust air speed which is a high processing parameter of homogeneity within a field of film thickness of a coating film, A process of decompressing inside of an airtight container to pressure to which a solvent evaporates violently at exhaust air speed found at this process, changing various temperature of a substrate, and asking for temperature of a substrate which is a high processing parameter of homogeneity within a field of film thickness of a coating film, Evaporation time when a solvent evaporates violently is variously changed by adjustment of exhaust air speed using a processing parameter for which it already asked, and it may be made to include a process of finding evaporation time which is a high processing parameter of homogeneity within a field of film thickness of a coating film.

[0013]It may be made to find evaporation time before the process of asking for the temperature of a substrate. [in this case the process of asking for the processing parameter at the time of decompression dryness] The process of changing various exhaust air speed until it decompresses the inside of an airtight container to the pressure to which a solvent evaporates violently from air atmosphere, and finding the exhaust air speed which is a high processing parameter of the homogeneity within a field of the film thickness of a coating film, A solvent decompresses the inside of an airtight container to the pressure which evaporates violently at the exhaust air speed found at this process, The process of changing variously the evaporation time when a solvent evaporates violently by adjustment of exhaust air speed, and finding the evaporation time which is a high processing parameter of the homogeneity within a field of the film thickness of a coating film, Then, the process of changing various temperature of a substrate and asking for the temperature of the substrate which is a high processing parameter of the homogeneity within a field of the film thickness of a coating film is included using the processing parameter for which it already asked.

[0014]It may be made to perform decompression dryness by forming a current plate so that it may counter with this near the substrate face, In this case, exhaust air speed until it decompresses the process of asking for the processing parameter at the time of decompression dryness, to the pressure to which a solvent evaporates violently from air atmosphere, After determining said evaporation time and the temperature of said substrate, it is preferred to change various gaps between a substrate and said current plate into the next, and to ask for the gap which is a high processing parameter of the homogeneity within a field of the film thickness of a coating film.

[0015]And in enlarging the gap between a substrate and said current plate while the solvent has evaporated violently again,After the process of asking for the processing parameter at the time of decompression dryness asks for the high gap of the homogeneity within a field of the film thickness of a coating film, it changes various timing which enlarges said gap using the processing parameter for which it already asked, and asks for the timing which is a high processing parameter of the homogeneity within a field of the film thickness of a coating film.

[0016]In the process of applying coating liquid to a product board in this invention after determining the processing parameter at the time of the application of coating liquid to a substrate, and the processing parameter at the time of decompression dryness, When two or more crevices are formed in the ground film of a product board in the shape of parallel, it may be made to decide direction of a product board that the direction where said crevice is prolonged, and the scanning direction of a coating liquid nozzle cross.

[0017]After determining the processing parameter at the time of the application of coating liquid to a substrate, and the processing parameter at the time of decompression dryness, it may be made to tune the already fixed scan pitch finely in the process of applying coating liquid to a product board, by this invention again according to the position of unevenness of the ground film of a product board.

[0018]The high result of the homogeneity within a field is obtained about the film thickness of a coating film by carrying out like this invention and determining a processing parameter.

[0019]In order to ask for a certain processing parameter, for example, the parameter at the time of decompression processing, above, when forming a liquid film using the processing parameter at the time of the already determined application, some width is given to the value with the processing parameter at the time of the already determined application here. For example, the scan pitch is already decided, and it is contained in this invention also when forming a liquid film by a scan pitch which is slightly different from said scan pitch when making a liquid film, in order to ask for the parameter of decompression dryness.

[0020]The coating liquid nozzle which the application device of this invention counters with the substrate attaching part holding a substrate, and the substrate held at this substrate attaching part, is formed, and carries out discharge of the coating liquid to the substrate concerned, The coating liquid supply control section which controls the discharge of the coating liquid from this coating liquid nozzle, Y direction drive made to move relatively intermittently the X direction drive made to move said coating liquid nozzle in the direction of X, and said substrate attaching part and a coating liquid nozzle in the direction of Y, The airtight container for carrying out decompression dryness of the substrate in which the liquid film of coating liquid was formed of said coating liquid nozzle, The storage part which remembers a processing parameter when forming the liquid film of coating liquid, and a processing parameter when carrying out decompression dryness to be evacuation means to evacuate the inside of this airtight container, Formation of the liquid film by a preparation and coating liquid moves the coating liquid nozzle concerned in the direction of X, making coating liquid breathe out from a coating liquid nozzle, where said substrate attaching part is stopped, A substrate attaching part and a coating liquid nozzle are relatively moved in the direction of Y after that, it is carried out by repeating this operation, and the processing parameter in a storage part is determined by an above-mentioned method.

[0021]
[Mode for carrying out the invention]The embodiment of the deciding method of the processing parameter in the coating film formation which is this invention is described below. This embodiment applies to a substrate the resist liquid which is coating liquid (medical fluid) by scanning application in the way of a picture drawn without lifting the brush from the paper, as the item of "conventional technology" already described, Subsequently, in the method of performing decompression dryness and forming the resist film which is a coating film, It clarifies how a suitable processing parameter is obtained, the application process and decompression drying process of resist liquid are first explained as an order of explanation, and the deciding method of a processing parameter is described after that.
[0022](an application process and decompression drying process) Drawing 1 shows how to apply the resist liquid RE which is coating liquid from the coating liquid nozzle 1 to the substrate (henceforth a "wafer") W, for example, a semiconductor wafer. 11 is a container which is a source of supply of coating liquid, and the resist liquid RE made to dissolve the resist ingredient which is solid content in a solvent is stored in this container 11. The resist liquid RE in the container 11 is supplied to the surface of the wafer W by the supply control section 12 via the feed pipe 13 and the coating liquid nozzle 1. The coating liquid nozzle 1 moves in the direction of X from the one end side at the other end side, breathing out the resist liquid RE, after the wafer W has stopped, and the wafer W moves it in the direction of Y after that. Then, the coating liquid nozzle 1 moves to the one end side from the other end side, and repeats this operation. The edge part of the wafer W is covered with the mask 14, and while the resist liquid RE from the coating liquid nozzle 1 is supplied on the mask 14, the wafer W moves in the direction of Y. Since the resist liquid RE is more detailed in the point of a picture drawn without lifting the brush from the paper and the mask 14 is on the wafer W as a result, it is applied in the state where it was arranged in parallel on a straight line.
[0023]The supply control section 12 of coating liquid applies coating liquid with predetermined discharge pressure by feeding back the pressure sensing value of the pressure detector 12b, and adjusting the bellows pump 12a, for example including the bellows pump 12a, the pressure detector 12b, the viscosity primary detecting element 12c, etc. Since discharge pressure and the amount of discharge flow have the most important relation if the hole diameter and viscosity (solid content concentration) of the coating liquid nozzle 1 are decided, If the related data of the amount of discharge flow and discharge pressure is given to the below-mentioned control part side at given viscosity and the viscosity primary detecting element 12c detects viscosity, the amount of discharge flow of coating liquid can be controlled by adjusting the discharge pressure of the bellows pump 12a.
[0024]Although the composition of the application unit which performs above-mentioned application processing is explained in full detail later, When movement of the coating liquid

nozzle 1 and the wafer W is briefly described here based on drawing 2, the coating liquid nozzle 1 will be attached to the mobile 21, and can be moved in the direction of X by rotating the ball screw part 22 by the motor M2. The wafer W will be held at the wafer attaching part 23, and can be moved in the direction of Y by rotating the ball screw part 24 by the motor M1. The motor M1, M2, and said supply control section 12 are controlled by the control part 3. That is, the amount of discharge flow of the resist liquid RE from the coating liquid nozzle 1, a scanning speed (movement speed of the direction of X) of the coating liquid nozzle 1, and the amount of intermittent sending of the direction of Y of the wafer W (scan pitch of the coating liquid nozzle 1) are controlled by this control part 3.

[0025]The decompression drying process performed after the application of resist liquid is carried out by the decompression dry unit 4 shown, for example in drawing 3. This decompression dry unit 4 is provided with the airtight container 40 constituted with the mounting base 41 and the lid 42 which lay the wafer W, The lid 42 is in an ascending position, when delivery of the wafer W is performed between the conveyance arm and the mounting base 41 which are not illustrated, and it is combined with the rising and falling mechanism which is not illustrated so that it may become the position closed like drawing 3, when carrying out the vacuum drying process of the wafer W. The mounting base 41 is constituted so that the wafer W may be laid in the state where it floated from the installation side slightly by the projection part, and the temperature control means 43 of the substrate is formed in the inside. Although the temperature control means 43 is set as 18 ** in this example, it may be made to use a heater as a heating method depending on the desired value of the temperature of the wafer W. Although not illustrated to the mounting base 41, from the installation side, three support pins penetrate enabling free frequent appearance, and are provided, and when delivering the wafer W between the conveyance arms which are not illustrated, the wafer W is raised by these support pin.

[0026]The exhaust pipe 44 is connected to the central part of the lid 42, and from the airtight container 40 side to this exhaust pipe 44 For example, the pressure detector 301 which detects the pressure in the exhaust pipe 44, the flow primary detecting element 302 which detects an exhaust air flow, the flow control part 45 which adjusts an exhaust air flow, the opening-and-closing valve V. And the vacuum pump 46 which is an evacuation means is formed. 303 is a controller, the control part 3 outputs the preset value of an exhaust air flow to the controller 303, and the controller 303 has a function which outputs the opening signal of the flow control part 45, for example, a valve, based on the preset value of the exhaust air flow from the control part 3, and the flow detection value from the flow primary detecting element 302. The time of the control part 3 decompressing the inside of the airtight container 40 to the pressure to which a solvent evaporates violently from atmospheric pressure, and henceforth [it], pressure preset values differ and the change of a pressure preset value is performed

based on the pressure sensing value of the pressure detector 301. The timing of the change of a pressure preset value grasps time beforehand, and may change it by a timer.

[0027]The current plate 31 of the same size as the effective field of the wafer W which is a substrate, or larger size, for example, somewhat larger size than the wafer W, than it is formed in the upper part side of the mounting base 41 so that it may counter with the wafer W laid in the mounting base 41 concerned. The effective field of the wafer W is a field where the resist film which is a coating film is utilized in this example, and is a device formation field. It is supported by two or more support members 32 in the edge part, these support member 32 penetrates the mounting base 41, and this current plate 31 is attached to the rise-and-fall base 33. 33a is a bellows for the decompression state in the airtight container 40 not to be broken via the penetration hole of the support member 32.

[0028][by arranging the ball screw part 35 in which the guide part 34 was screwed at the lower part side of the rise-and-fall base 33, and rotating the ball screw part 35 by an actuator containing the motor M3 and the belt pulley 36] It has composition which the connection object 37 in which both ends were supported pivotably by the guide part 34 and the rise-and-fall base 33 rotates, and the current plate 31 goes up and down. Said heater 43, the flow control part 45, and the motor M3 are controlled by said control part 3.

[0029]In such a decompression dry unit 4, after the wafer W is laid in the mounting base 41, the lid 42 is closed and the airtight container 40 is formed, the valve V is opened and inside of the airtight container 4 is evacuated. A graph shown as a solid line of drawing 4 shows pressure variation in the airtight container 40, pressure falls gently until this graph is quickly decompressed till the time t1 and results in t2 from the time t1, and a stair-like curve decompressed quickly is drawn after time t2. It is in a state where air in the airtight container 40 is exhausted about a state of each stage until it continues till the time t1, It is in a state where a solvent in coating liquid on the wafer W has evaporated, and inside of the airtight container 40 has become the steam pressure of a solvent mostly until it results in t2 from the time t1, and it is in a state where gas which a solvent evaporated and remains in the airtight container 40 is exhausted, after the time t2.

[0030]By the way, strictly, although atmospheric pressure has also evaporated slightly, a solvent will be evaporated from the inside of a solvent by a certain pressure decided by temperature, if pressure is lowered. although this state is in what is called a boil state, it boils at this embodiment -- if a few is said by boil of a front state and the water in 1 atmosphere, a solvent will be evaporated in the state of mist or a low temperature from 100 **. this state is "pressure to which a solvent evaporates violently" said by Claims, if it evacuates not much quickly, it will be in a boil state, but it results in boil by adjusting the exhaust air speed 45, i.e., a flow control part, and adjusting an exhaust air flow -- it will be in a front state for a while. The value of the pressure to which a solvent evaporates violently is, for example before and after

about 1.33 kPa(s) (1Torr), and the temperature of the wafer W at this time is about 18 **, and this state continues till the time t2. If an example is given, about 90 l. of steam will evaporate to the capacity of about 30-l. airtight container 40. Even if the inside in particular of the airtight container 40 does not carry out pressure regulation, pressure declines with time slightly, until it results in t2 from the time t1.

[0031]Therefore, the time of beginning to evaporate violently as a processing parameter at the time of decompression dryness, exhaust air speed, i.e., a solvent, until it continues till the time t1, is mentioned. This is decided by temperature of the wafer W which influences steam pressure although the pressure in the airtight container 40 when the solvent has evaporated violently is mentioned. Although the time t2 of evaporation of a solvent being completed is mentioned, this is controllable by adjusting an exhaust air flow, after a solvent begins to evaporate violently. As a processing parameter, the height of the current plate 31, i.e., the gap of the current plate 31 and the wafer W, is mentioned again.

[0032]About the Reason for having formed the current plate 31, the liquid film RM by the coating liquid on the wafer W is round from a rim to an about 2-cm part with surface tension, as shown in drawing 5 (a), If a solvent evaporates as it is, since the homogeneity within a field of an edge part will worsen, by making the current plate 31 counter immediately on the wafer W, the air current which goes outside from the center of the wafer W is formed, coating liquid is pushed aside outside, and this eases roundness. However, the air current which goes outside needs to become strong too much, if a gap is not much small, as shown in drawing 5 (b), the edge part of a liquid film needs to rise and it is necessary to project, and it is necessary to find the optimal gap from it being round if a gap is too large conversely. Even if it finds the optimal gap, climax of the edge part of a liquid film is unavoidable, it is preferred to enlarge a gap in the state where the solvent has evaporated violently for this reason, and that timing also serves as a processing parameter in this case.

[0033](determination of a processing parameter) Although an application and decompression dryness of the resist liquid RE are performed as mentioned above, it states, referring to drawing 6 for the technique of the determination of a processing parameter in which the target film thickness of the resist film beforehand set up in these processes is obtained.

[0034]** Calculate the optimal value of the solid content (resist ingredient) concentration of a medical fluid (resist liquid) first (Step S1). Irrespective of solid content concentration, this invention person has found out that there is the optimal value for the film thickness of the liquid film of a medical fluid, and attains optimization of solid content concentration based on this. Using the medical fluid of suitable solid content concentration, this process applies a medical fluid on the wafer W by the suitable amount of discharge flow and scan pitch by the coating liquid nozzle 1 of a suitable hole diameter, and forms a liquid film, Decompression dryness is performed after that, a solvent is volatilized, the resist film which is a coating film is formed,

and the homogeneity within a field about the film thickness is measured. And various the amounts of discharge flow and hole diameters of a scan pitch or the coating liquid nozzle 1 are changed, the liquid film of various film thickness is formed, a relation with the homogeneity within the field of the film thickness of a liquid film and film thickness is grasped, and it asks for the best (the variation in film thickness is the smallest) liquid film of the homogeneity within a field.

[0035]About a scanning speed (movement speed of the direction of X) of the coating liquid nozzle 1, it sets [sec] up in 1 m /. I hear that the target film thickness which it is actual use setting up suitably and obtains solid content concentration, the amount of discharge flow, the hole diameter of a nozzle, and a scan pitch is set up, and it sets to the value within the commonsense limits grasped to some extent by experiment from which this target film thickness is obtained, and it is. A fixed value is used when determining the processing parameter of those with ****, and the application process of a medical fluid similarly chosen from the commonsense range about the processing parameter used in the decompression drying process after the application of a medical fluid. Although a definition can be given except for 3 mm as 3 times as much 3sigma (%) as the standard deviation of film-thickness-measurement data from a rim, for example, [be / with the homogeneity within a field of film thickness / that a film rises near a rim by a decompression drying process / unavoidable] The value which broke by average film thickness the value which deducted the minimum from the maximum of film-thickness-measurement data may be used.

[0036]Drawing 7 shows the relation between a processing parameter and the homogeneity within the field of film thickness in image, and drawing 7 (a) shows the relation between the thickness of a liquid film, and the homogeneity within the field of film thickness. From this result, the optimal value exists in the film thickness value of a liquid film, and this value is not influenced by the solid content concentration of the resist liquid RE like previous statement. Therefore, the solid content concentration of a medical fluid is decided based on this film thickness value and the target film thickness of the resist film finally obtained (solvent evaporation back) (Step S2). Target film thickness here is the target film thickness which it is going to obtain about the product wafer W. For example, suppose that it was the optimal when the film thickness of a liquid film was 10 micrometers, and the film thickness of the resist film at that time was 1 micrometer using the resist liquid RE whose solid content concentration is 10 weight %. In this case, what is necessary is just to carry out solid content concentration to 20weight % which doubled 10 weight %, supposing the target film thickness of a resist film is 2 micrometers. In this way, solid content concentration can be found.

[0037]** The coating liquid nozzle 1 of a medical fluid adjusted at Step S2 next and a suitable diameter of a nozzle is used, As various scan pitches and amounts of discharge flow of the coating liquid nozzle 1 are changed so that target film thickness (desired value of film

thickness after decompression dryness) of a resist film may be obtained, a processing parameter suitable after that is set, decompression dryness is performed and it is shown in drawing 7 (b), It asks for relation between the homogeneity within a field of film thickness of an obtained resist film, and a scan pitch. And the best scan pitch of homogeneity within a field is determined as a value of a processing parameter, when forming a resist film of the target film thickness concerned (Step S3). Although a scan pitch is the amount of intermittent sending of the direction of Y of the coating liquid nozzle 1 like previous statement, if it sees from a line of the resist liquid RE, it will become an image shown in drawing 8.

[0038]If a scan pitch is decided here, the length (the total extension) of the whole scan by the coating liquid nozzle 1 in coating regions will be decided geometrically. Since a scanning speed of the coating liquid nozzle 1 is beforehand set [sec] up in 1 m /, if the amount of discharge flow is decided to be a certain value, quantity of the whole medical fluid when the total extension of coating regions is scanned will be decided. If target film thickness, solid content concentration of a medical fluid, and area of coating regions of the wafer W are known on the other hand, since quantity of a medical fluid piled in coating regions will be decided, quantity of the whole medical fluid has already been decided. I hear that a scan pitch is decided uniquely and there is this, if the amount of discharge flow is decided. Since the wafer W is mentioned as an example as a substrate in this example, a rim is stair-like and, for this reason, shape of coating regions will calculate a scan pitch using a predetermined algorithm, but. For example, the calculation is simple if it is a substrate of square-shaped shape, such as a glass substrate for liquid crystal displays, or a glass substrate for exposure masks.

[0039]** Step S2 continuously, [using the medical fluid of the determined solid content concentration] [the scan pitch and the amount of discharge flow which were determined at an above-mentioned scanning speed and Step S3] As resist liquid is applied using the coating liquid nozzle 1 of various hole diameters (diameter of a nozzle), it sets to the value of a processing parameter suitable after that, for example, the same processing parameter as the time of Step S3, decompression dryness is performed and it is shown in drawing 7 (c), It asks for the relation between the homogeneity within a field of the film thickness of the obtained resist film, and the diameter of a nozzle. And the best diameter of a nozzle of the homogeneity within a field is determined as a value of a processing parameter when forming the resist film of the target film thickness concerned (Step S4).

[0040]** Determine the processing parameter at the time of decompression dryness after determining the processing parameter at the time of application processing of coating liquid as mentioned above. About the wafer W in which decompression dryness is performed, resist liquid is applied using the already decided processing parameter (solid content concentration, a scanning speed, a scan pitch, the amount of discharge flow, and the diameter of a nozzle of the coating liquid nozzle 1).

[0041]Various exhaust air speed until the time of a solvent beginning to evaporate violently first, i.e., a solvent, begins to evaporate violently is changed. Signs that this exhaust air speed was changed are shown in drawing 4, and if exhaust air speed is made small with VA1 to VA2, the time of a solvent beginning to evaporate violently will be overdue. And as it fixes to the suitable value, other processing parameters obtain a resist film and it is shown in drawing 7 (d), It asks for the relation between the homogeneity within a field of the film thickness of the obtained resist film, and exhaust air speed, and the best exhaust air speed of the homogeneity within a field is determined as a value of a processing parameter when performing actual processing (Step S5). This processing parameter (exhaust air speed) is equivalent to the flow rate set value outputted from the control part 3 in this example.

[0042]** Set exhaust air speed until a solvent next begins to evaporate violently as the exhaust air speed found at Step S5, control the temperature control means 43, and change various temperature of the wafer W. Signs that the temperature of the wafer W was changed are shown in drawing 4, and if temperature is lowered to T2 from T1, since the steam pressure of a solvent will fall, the pressure in the airtight container 40 falls. In this case, about the gap between the current plate 31 and the wafer W, and the exhaust air speed [the solvent has evaporated violently] of a between, the value considered to have not separated so greatly is selected from the suitable value. And as shown in drawing 7 (e), it asks for the relation between the homogeneity within a field of the film thickness of the obtained resist film, and the temperature of the wafer W, and the temperature of the best wafer W of the homogeneity within a field is determined as a value of a processing parameter when performing actual processing (Step S6).

[0043]** Set to the value which ranked second and already asked for the processing parameter at Step S5 and Step S6, change various time which changed various exhaust air speed [the solvent has evaporated violently] of a between and when it has evaporated violently at the end time of evaporation of a solvent, i.e., a solvent, and perform decompression dryness. The control part 3 outputs a flow rate set value which is different even in it, for example, when the time beforehand set up when a pressure sensing value became near the steam pressure of a solvent when a solvent becomes the pressure which evaporates violently that is, passes, but. [the part] "The time (exhaust air speed) when the solvent has evaporated violently" to be a processing parameter for which it asks at the step concerned is equivalent to this flow rate set value. Signs that the end time of evaporation of a solvent changes by changing exhaust air speed are shown in drawing 4, and said end time is overdue by lowering exhaust air speed to VB2 from VB1 (solvent evaporation time becomes long). And as shown in drawing 7 (f), it asks for the relation between the homogeneity within a field of the film thickness of the obtained resist film, and solvent evaporation time, and decides on the best solvent evaporation time of the homogeneity within a field as a value of a processing parameter when performing actual

processing (Step S7).

[0044]** Set to the value which ranked second and already asked for the processing parameter at Step S5 - Step S7, change various gaps between the current plate 31 and the wafer W, and perform decompression dryness. And as shown in drawing 7 (g), it asks for the relation between the homogeneity within a field of the film thickness of the obtained resist film, and a gap, and the best gap is determined as a value of a processing parameter when performing actual processing (Step S8).

[0045]Thus, the application of coating liquid and a series of processing parameters at the time of decompression dryness are determined. In a decompression drying process, in enlarging the gap of the current plate 31 and the wafer W during evaporation of a solvent, it is Step S8, next various timing which enlarges a gap is changed using the processing parameter for which it already asked, and it obtains a resist film. And it asks for the relation between the homogeneity within a field of the film thickness of the obtained resist film, and said timing, and the best timing of the homogeneity within a field is determined as a value of a processing parameter when performing actual processing. Since pressure becomes low gradually in the state where the solvent has evaporated violently, the timing which enlarges a gap can be regarded as a pressure value.

[0046]When deciding the processing parameter of a decompression drying process here and the obtained film thickness (average film thickness within a field) has shifted from target film thickness although the homogeneity within a field of film thickness is high, the gap of a current plate or the temperature of the wafer W is the optimal value, for example, but. When it has shifted from target film thickness, the processing parameter, for example, the scan pitch, and the amount of discharge flow in an application process of coating liquid are finely tuned so that the film thickness of a resist film may turn into target film thickness.

[0047]Thus, the decided processing parameter is memorized in the memory of the control part 3, it is read at the time of actual processing, and a device is controlled based on the value. Although the solid content concentration of a medical fluid may be mixed by a worker's manual labor, when concentration adjustment of a medical fluid is performed, for example by the application unit side, solid content concentration is also memorized in a memory.

(Effect of an embodiment) According to the above-mentioned embodiment, it notes that the suitable thickness of the liquid film of resist liquid exists irrespective of the solid content concentration of resist liquid, Since it asked for the solid content concentration of the resist liquid in which target film thickness is obtained and the processing parameter is subsequently decided in above-mentioned order after finding this value first, the high resist film of the homogeneity within a field is obtained. Specifically, the homogeneity within [no less than **0.9% of / high] a field was acquired.

[0048]And he decides the drying time of a solvent and is trying to decide the gap of the current

plate 31 and the wafer W subsequently as a processing parameter in the case of performing decompression dryness. If the drying time of a solvent is too short, it will become the appearance with which the resist film obtained united drawing 5 (a) and (b). That is, it becomes the shape where the part until it is round toward the position of about 30 mm to a periphery from the edge part of the wafer W and results inside about 1-2 mm from a periphery rose keenly. Therefore, although it is required to keep the drying time of a solvent from becoming not much short, when the drying time of a solvent is too long in one side, there is a disadvantage to which an edge part becomes the shape near drawing 5 (b), and also a throughput becomes low. Then, it is necessary to find suitable drying time, and he is trying for the temperature and the exhaust air flow of the wafer W at the time of volatilization of a solvent to determine the optimal drying time. Therefore, in deciding a processing parameter, the temperature of the wafer W may be decided first as mentioned above, but an exhaust air flow (exhaust air flow when the solvent has evaporated violently) may be first decided before that.

[0049]On the other hand, if the gap of the current plate 31 and the wafer W is narrow, in order for there to be a phenomenon of being easy to flow through the liquid of a coating film and to make the film of the edge part of the wafer W flat, it is required to pass a certain volume toward an edge part, but. In that case, if there is little volume, flat-ization cannot be attained, but if conversely large, an edge part will rise. Based on the above thing, by the above-mentioned embodiment, suitable drying time was secured first and the volume which fixes the gap of the current plate 31 and the wafer W to a suitable position on it, and goes to the periphery of the wafer W is controlled. Therefore, the high resist film of the homogeneity within a field is obtained, and a processing parameter is made as for easy arrangement ****** to a suitable value. In this way, according to the above-mentioned embodiment, since an order of how to ask for the optimal processing parameter is decided, compared with the case where the processing parameter is decided by trial and error, a setup of a parameter and what is called condition **** become easy, and time to spend on it can be shortened sharply.

[0050](Example of a concrete equipment configuration) It explains, referring to drawing 9 and drawing 10 for the equipment configuration of the application unit for next applying resist liquid. This application unit is provided with the following.

The case body 52 by which the opening 51 (refer to drawing 10) which makes the taking-out entrance of a wafer was formed in the front.

The wafer attaching part 23 which is provided into this case body 52, and can move in the direction of Y intermittently, for example, has a vacuum zipper function.

The wafer attaching part 23 can be gone up and down now via the rise-and-fall axis 23b according to the rising and falling mechanism 23a. This rising and falling mechanism 23a is arranged on the movable carriage 24b which can move in the direction of Y by the ball screw part 24 driven by the motor M1, being guided to the guide part 24a. The motor M1, the ball

screw part 24, and the guide part 24a make Y direction drive. The slit 54 extended in the direction of X is formed in the top plate 53 of the case body 52 (the part is shown in drawing 10), the upper part projects on the top plate 53 in this slit 54, and the coating liquid nozzle 1 is formed so that a lower discharge opening may be located in the lower part side of the top plate 53 and it may counter with the wafer W. The discharge opening of said coating liquid nozzle 2 is extremely formed in the narrow diameter, for example with 10 micrometers - 200 micrometers.

[0051]The guide part 25 extended along the direction of X is constructed above the top plate 53 via the supporter 26, and the coating liquid nozzle 1 is attached so that it can move along with this guide part 25 via the mobile 21. Said mobile 21 will be screwed with the ball screw part 22 extended in the direction of X, and the coating liquid nozzle 1 can move in the direction of Y via this mobile 21 by rotating the ball screw part 22 by the motor M2. The motor M2, the guide part 25, and the ball screw part 22 make an X direction drive. Since solvent steam is full when having applied resist liquid to the wafer W by surrounding the movement region of the wafer W by the case body 52, and making into the narrowest possible closed space space on which the wafer W is put, volatilization of the solvent from the applied resist liquid can be suppressed. In this case, when providing a temperature control means in the top plate 53, and keeping the temperature of said space as constant as possible improves the homogeneity within a field of film thickness, it is preferred.

[0052]If said coating liquid nozzle 1 is moved in the direction of X, breathing out resist liquid, in order for resist liquid to adhere to the periphery of the wafer W and to turn also to the back, In order to prevent this, the whole edge part of the wafer W is covered, and the mask 14 in which the part corresponding to the circuit formation field which is a coating film formation field is carrying out the opening is formed on the wafer W. This mask 14 is laid on the mask supporter 14a which is attached to the movable carriage 24b which moves the wafer W in the direction of Y, for example, is beginning to be extended from a way to a position somewhat higher than the surface of the wafer W outside the both sides of the wafer W.

[0053]If it sees from the opening 51 of the case body 52 temporarily now and the end of the wafer W by the side of the back of the case body 52 (it is right-hand side in drawing 10) is used as a front end part, the wafer attaching part 23 is located so that the front end part of the wafer W may be located just under the direction scan field of X of the coating liquid nozzle 1, for example. And the wafer attaching part 23 moves in the direction of Y intermittently in a predetermined pitch from here. On the other hand, the coating liquid nozzle 1 carries out both-way movement in the direction of X corresponding to the timing of intermittent movement of the wafer W, it carries out like previous statement, and resist liquid is applied on the wafer W. Although the outline of the periphery of the circuit formation field of the wafer W is a stair-like line so to speak and the opening of the mask 14 has become the shape united with this, it is

formed so that the edge of an opening may become outside for a while rather than said outline, for example.

[0054]It may be performed as follows when a ground film has unevenness, if it sees from the film already formed on the surface of the substrate here, i.e., a resist film. When the convex part 62 shown in the crevice 61 and white field which are shown in the slash field is prolonged on the wafer surface on which resist liquid will be applied from now on in the shape of parallel and formed in it, [drawing 11] How to make the coating liquid nozzle 1 scan in the direction, for example, the direction which intersects perpendicularly, which crosses to the direction where the crevice 61 and the convex part 62 are prolonged is shown. When the wafer W is carried in to the wafer attaching part 23, this method installs CCD camera 7 which is an imaging means so that the surface of this wafer W may be picturized, and, for example. [a method] [in an application unit as stated above] The wafer attaching part 23 is constituted enabling free rotation, and it carries out by picturizing the surface of the wafer W carried in to the wafer attaching part 23, and rotating the wafer attaching part 23 based on the image pick-up result. For example, if the wafer attaching part 23 is rotated so that said control part 3 may process the picturized picture, the direction where the crevice 61 of the surface of the wafer W and the convex part 62 are prolonged may be judged and the direction which has extended may turn into the direction of Y, This will scan the coating liquid nozzle 1 in the direction where the crevice 61 and the convex part 62 are prolonged, and the direction which intersects perpendicularly. or [that the influence of the thickness fluctuation of a ground film is lost according to this method] -- or since it is eased, the flat nature of resist liquid is good, as a result, the high resist film of the homogeneity within a field of film thickness is obtained, and a good resist pattern is obtained.

[0055]The following methods may be used as a method of acquiring such an effect. For example, when the crevice 61 and the convex part 62 exist as shown in drawing 12 as a result of picturizing with CCD camera 7, The direction where the crevice 61 and the convex part 62 are prolonged is united in the direction which the coating liquid nozzle 1 scans, as shown in drawing 13, in the crevice 61, a scan pitch is made small, and a scan pitch is enlarged in the convex part 62. For example, when the scan pitch is already set up, in the convex part 62, it applies by the scan pitch, and is made somewhat smaller than the scan pitch set up in the crevice 61. That judgment which is the convex part 62 or is the crevice 61 is made based on the image pick-up picture of a substrate face by the control part 3 side, and the map of the crevice 61 and the convex part 62 is formed about the whole wafer W. The control part 3 grasps the timing applied by the scan pitch set up beforehand, and the timing applied by a somewhat small scan pitch based on this map.

[0056]If mentioned already about the crevice 61 and the convex part 62, the chip is formed in the wafer W in all directions, and the circuit is formed in each chip. For this reason, if it sees

with the line of thin width in alignment with the lengthwise direction or transverse direction of the chip, in the field corresponding to one chip, the mean density of the circuit pattern on said line is the same in any chip. Therefore, if it sees by the whole wafer W, the mean density of the circuit pattern on said line will become anywhere the same. In the ground film seen from the resist which it is going to apply on the other hand after this, the place where the mean density of said circuit pattern is high will be equivalent to the convex part 62, and the place where the mean density of said circuit pattern is low will be equivalent to the crevice 61. For this reason, when the concept of the height of an average of the field corresponding to one chip on said line is carried out, the crevice 61 or the convex part 62 will be prolonged along said line top.

[0057]Next, it explains, referring to drawing 14 and drawing 15 for the outline of an example of application / development system incorporating an above-mentioned application unit and decompression dry unit. the cassette C which nine are a carrying-in appearance stage for carrying out carrying-in appearance of the wafer cassette among drawing 14 and drawing 15, for example, was stored 25 sheets is laid by the automatic transfer robot. The delivery arm 90 of the wafer W is formed in the field facing the carrying-in appearance stage 9, enabling X, Z, the direction of Y, and free theta rotation (rotation of the circumference of a vertical axis). The unit group U1 which looks at the back, for example from the carrying-in appearance stage 9, for example, contains the application unit 92 and the development unit 91 on right-hand side is arranged at the back side of this delivery arm 90, The unit group U2 which a warming unit, a refrigeration unit, a decompression dry unit, etc. put on multi stage, and was constituted, U3, and U4 are arranged at the left-hand side [of the delivery arm 90], this side, and back side, respectively. The wafer conveyance arm MA which it comprised enabling the rotation free [movement to rise-and-fall ease, right and left, and order] and free to the circumference of a vertical axis in order to deliver the wafer W between the application unit 92, the development unit 91, and the unit group U2, U3 and U4 is formed. However, in drawing 14, the unit u2 and the wafer conveyance arm MA are not drawn for convenience.

[0058]If the above-mentioned portion containing the unit group U1, U2, U3, and U4 will be called a process station block, the exposure device 101 is connected to the back side of this process station block via the Interface Division block 100. The Interface Division block 100 delivers the wafer W between the exposure devices 101 by rise-and-fall ease, right and left, and the wafer conveyance arm 102 constituted enabling the rotation free [movement to order], and free to the circumference of a vertical axis.

[0059]If the flow of the wafer of this device is explained, the wafer cassette C in which the wafer W was first stored from the exterior will be carried in to said carrying-in appearance stage 9, The wafer W is taken out from the inside of the cassette C by the wafer conveyance arm 90, and the wafer conveyance arm MA is won popularity and passed via the delivery stand which is one of the shelves of the unit group U3 as stated above. Subsequently, after canal-

ized processing of the shelf of 1 of unit U3 group is performed, resist liquid is applied in the application unit 92, and a resist film is formed. After the wafer W in which the resist film was applied was dried in the decompression dry unit, It is conveyed by the wafer conveyance arm 102 of the interface block 100 of the unit group U4, and the refrigeration unit of the unit group U4 which can be delivered, It is sent to the exposure device 101 via the Interface Division block 100 and the wafer conveyance arm 102 after processing, and exposure is performed via the mask corresponding to a pattern here. The wafer after exposure processing is received with the wafer conveyance arm 102, and the wafer conveyance arm MA of a process station block is passed via the delivery unit of the unit group U4.

[0060]After this, the wafer W is heated by prescribed temperature with a warming unit, after an appropriate time, it is cooled by prescribed temperature, a processing procedure is continuously sent and carried out to the development unit 91 with a refrigeration unit, and a resist mask is formed. The wafer W is returned in the cassette C on the carrying-in appearance stage 9 after an appropriate time.

[0061]In determining a certain processing parameter at the time of decompression dryness, in this invention, the optimal value is determined by changing various preset values of the parameter concerned, where other parameters are fixed like previous statement, but. For example, it may be made to predict the optimal value beforehand by a simulation based on a physical-properties value or an already regular parameter setup value. Since pressure to which a solvent begins to evaporate violently by steam pressure which is the physical-properties value will be grasped to some extent if a solvent in coating liquid is chosen, for example if a concrete example is given, exhaust air speed until a solvent begins to evaporate violently by this is predicted, and also an initialized value of temperature of the wafer W is decided. Solvent evaporation time is predicted from the amount of coating liquid it is already decided that will be the steam pressure concerned, and solid content concentration, and let a predicted value be an initialized value at the time of changing various preset values of each parameter. In this case, although a parameter will be determined in this example in order of exhaust air speed, temperature of the wafer W, solvent evaporation time, and a gap, if it does in this way and the optimal value is predicted, it will become easy to calculate the actual optimal value, and shortening of time which parameter determination takes as a result can be attained.

[0062]As for an order of determining the processing parameter at the time of decompression dryness, in this invention, deciding in order of previous statement is desirable. However, make it the order which a simulation tends to perform when using the technique of predicting the above mentioned initialized value, or, The composition of a vacuum drying device given in drawing 3, for example, the heating capability of the heater 43, the exhaust air capacity of the vacuum pump 46, When the selectable range of each processing parameter is restricted by the restriction by the side of [, such as the amount of rise and fall of the current plate 31,] hard,

it may be made to change an order of determining a processing parameter, such as using the narrow order of a thing of the selectable range. Thus, even if an order is changed and it determines a processing parameter, a setup of a parameter becomes easy and the same effect as the case where it is **** can be acquired.

[0063]It may be an LCD board and a substrate for exposure masks, and the substrate processed in this invention above may not be restricted to resist liquid as coating liquid, and may be a fluid for interlayer insulation films, a fluid for high conductivity films, a fluid for ferroelectric films, a silver paste, etc., for example.

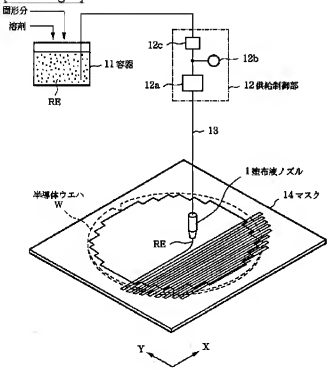
[0064]

[Effect of the Invention]According to this invention, it notes that the suitable thickness of the liquid film of coating liquid exists irrespective of the solid content concentration of coating liquid, Since it asks for the solid content concentration of the coating liquid in which target film thickness is obtained, the amount of discharge flow from a scan pitch and a coating liquid nozzle is subsequently calculated and it is asking for the processing parameter of decompression dryness after that after finding this value first, the high coating film of the homogeneity within a field is obtained. A setup of the parameter for the high coating film of the homogeneity within a field being obtained, and obtaining required film thickness is easy by having found the setting order optimal also about various processing parameters of decompression dryness.

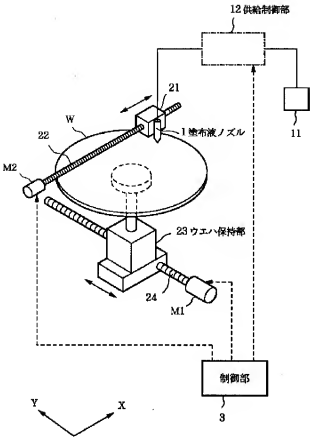
[Translation done.]

DRAWINGS

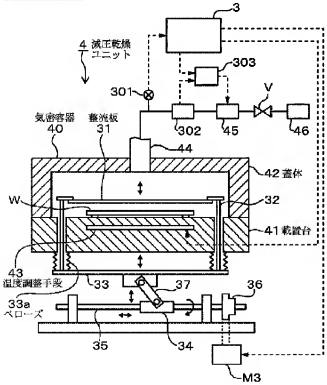
[Drawing 1]



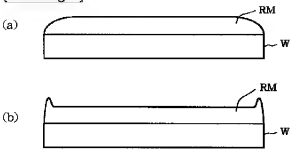
[Drawing 2]


12 供給制御部
21
W
22
1 塗布液ノズル
11
M2
23 ウエハ保持部
24
M1
制御部
3
Y
X

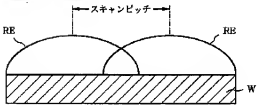
[Drawing 3]


3
4 減圧乾燥ユニット
303
301
V
気密容器 整流板
40 31
302 45 46
44
42 蓋体
W
32
41 載置台
43
温度調整手段
33 37 36
33a
ベローズ
35 34
M3

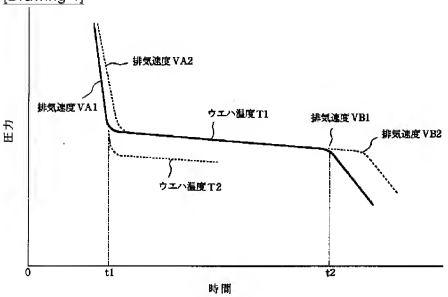
[Drawing 5]



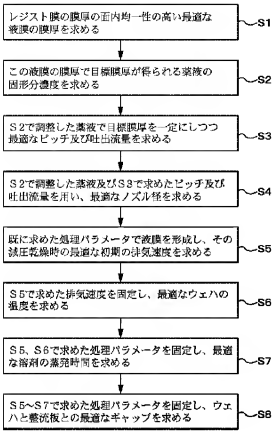
[Drawing 8]



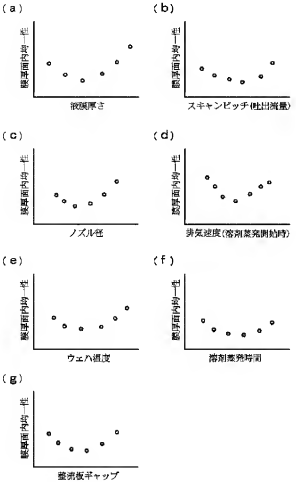
[Drawing 4]



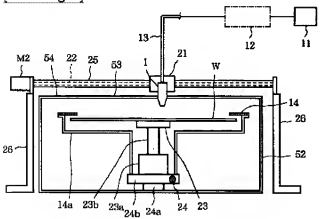
[Drawing 6]


レジスト膜の膜厚の面内均一性の高い最適な塗膜の膜厚を求める
S1
この塗膜の膜厚で目標膜厚が得られる塗液の固形分濃度を求める
S2
S2で調整した塗液で目標膜厚を一定にしつつ最適なピッチ及び吐出流量を求める
S3
S2で調整した塗液及びS3で求めたピッチ及び吐出流量を用い、最適なノズル径を求める
S4
既に求めた処理パラメータで塗膜を形成し、その減圧乾燥時の最適な初期の排気速度を求める
S5
S5で求めた排気速度を固定し、最適なウェハの温度を求める
S6
S5、S6で求めた処理パラメータを固定し、最適な溶剤の蒸発時間を求める
S7
S5～S7で求めた処理パラメータを固定し、ウェハと整流板との最適なギャップを求める
S8

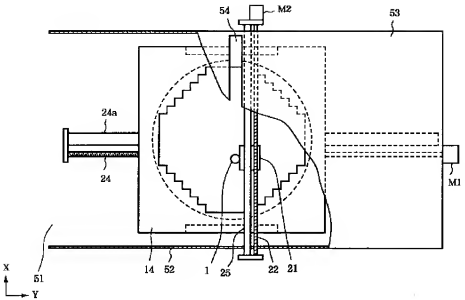
[Drawing 7]



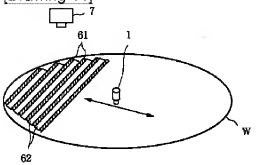
[Drawing 9]



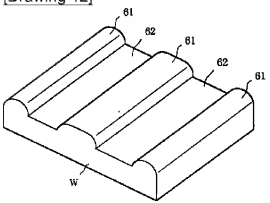
[Drawing 10]



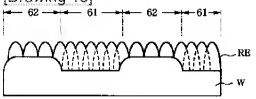
[Drawing 11]



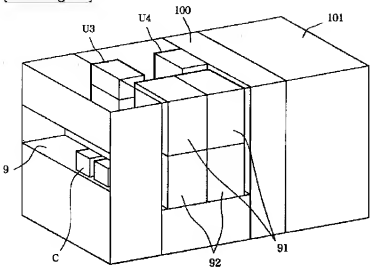
[Drawing 12]



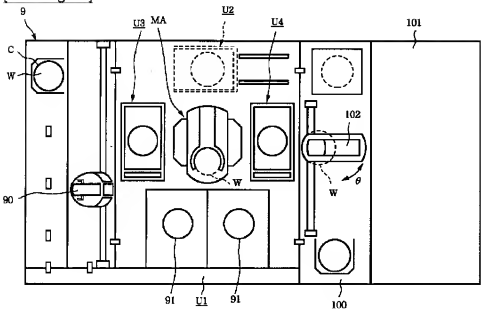
[Drawing 13]



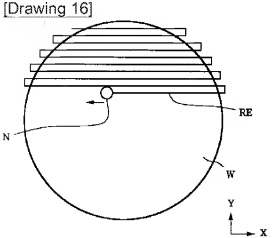
[Drawing 14]



[Drawing 15]



[Drawing 16]



[Translation done.]